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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/630,114	07/29/2003	Charles H. Dennison	MI22-2346	8334
21567	7590	10/05/2004	EXAMINER	
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			ROCCHIGIANI, RENZO	
			ART UNIT	PAPER NUMBER
			2825	
DATE MAILED: 10/05/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/630,114

Applicant(s)

DENNISON, CHARLES H.

Examiner

Renzo N. Rocchegiani

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 42-48 and 53-66 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 42-48 and 53-66 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 42-46, 54-57, 62-63 and 65 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,081,021 (Gambino et al.).

Gambino et al. disclose a semiconductor assembly comprising an insulative mass (item 307) across a first and second electrical nodes that comprise metals such as aluminum separated by dielectric material laterally adjacent thereto (Fig. 4, and col. 5, lines 15-20). The mass has been patterned to have a pair of opening to uncover the two nodes. (Fig. 5, items 320 and 330). A dielectric layer, such as silicon nitride about 5 to 200 nm thick (col. 5, lines 25-30, item 322), is present on the sidewalls of the openings and on the bottom of only one of the openings. (Fig. 7). Two conductive plugs are present in the opening wherein one is in contact with one of the nodes while the other is separated from the node by way of the dielectric layer formed in the via. (Fig. 8, item 324). Wherein the node (310) covered with the layer of nitride forms an antifuse. (col. 4, lines 45-50) The other node and conductive plug are incorporated into an interconnect construction. (col. 4, lines 45-55). The conductive plugs comprise a metal such as aluminum or titanium or copper or tungsten and may comprise multilayer

structures. (col. 5, lines 5-15). In patterning the dielectric layer that is deposited in the vias, Gambino et al. disclose the use of a mask. (col. 6, lines 35-42).

Whether the patterning of the insulative mass to form the openings to exposes the nodes was carried out simultaneously or in different steps is not limiting since such limitation is a process limitation and this is a device claim and in product by process claims the Patent Office follows *In re Thorpe* and does not give weight to the process steps.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,191,241 (McCollum et al.) and in further view of U.S. Patent No. 5,110,754 (Lowrey et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the nodes comprise n-type and p-type regions.

McCollum et al. teach the formation of an antifuse (item 336) in an integrated circuit wherein the nodes comprise source and drain regions doped in the substrate (items 314 and 316, and col. 6, lines 20-25).

Lowrey et al. teach the formation of an antifuse wherein the nodes comprise n-type and p-type regions. (Fig. 13)

It would have been obvious to one having ordinary skill in the art to have the node regions comprise n-type and p-type, since Gambino et al. discloses that the nodes in its invention are interconnect structures, because McCollum teaches a very similar structure that Gambino et al. disclose except that it is more specific as to what the interconnect structure would be connected to, i.e. separate source and drain regions, and since Lowrey et al. teach what such source and drain regions are made of, i.e. n-type and p-type dopant, thus in light of the teachings of these three references one with ordinary skill in the art would recognize that these elements work together and thus would have an expectation of success in combining them.

5. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,110,754 (Lowrey et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the plug is formed with polysilicon.

Lowrey et al. teach the formation of an antifuse wherein the nodes comprise n-type and p-type regions (Fig. 13) and wherein the plug comprises a metal or polysilicon. (col. 4, lines 33-45).

It would have been obvious to one having ordinary skill in the art to use polysilicon for the plugs, since it has been held to be within the general skill of a worker

in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

6. Claims 58, 64 and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,171,715 (Husher et al.).

As stated in paragraph 2, all the limitations of the claims have been met except for teaching that the node and the plug are a mixture of aluminum and copper.

Husher et al. teach the formation of an antifuse wherein the node and the plug are a mixture of aluminum and copper. (col. 5, lines 1-9 and col. 7, lines 1-9).

It would have been obvious to one having ordinary skill in the art to form the node and plugs of a mixture of aluminum and copper, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

7. Claim 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 6,087,677 (Wu).

As stated in paragraph 2, all the limitations of the claims have been met except for specifying that the plug comprises TiN and W.

Wu teaches an antifuse wherein the plug may comprise TiN and W. (col. 1, lines 45-50).

It would have been obvious to one with ordinary skill in the specific art to combine the teachings of Wu to those of Gambino, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its

suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims 60-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,081,021 (Gambino et al.) in view of U.S. Patent No. 5,830,797 (Cleeves).

As stated in paragraph 2, all the limitations of these claims have been met except for teaching that the isolation or dielectric material separating the nodes comprises a chemical constituency different from the insulative mass or a shallow trench isolation.

Cleeves teaches that shallow trench isolation regions comprising BPSG or oxides or SOG (col. 11, lines 43-50) may be used in separating interconnect structures. (Fig. 51-60).

It would have been obvious to one with ordinary skill in the specific art to combine the teachings of Cleeves to the invention of Gambino et al. and form the dielectric or insulative region with a STI thus of a different material from the insulative mass, since Gambino et al. explicitly discloses that the nodes are representative of interconnect structures and Cleeves teaches a well known and efficient way to form interconnect structures with good isolation, thus one with ordinary skill in the art would have an expectation of success in combining the teachings of Cleeves to the invention of Gambino et al..

Response to Arguments

9. Applicant's arguments filed June 28, 2004 have been fully considered but they are not persuasive. Applicant has presented various arguments as to why the pending

claims are not anticipated or rendered obvious by the prior art, yet none of these arguments are persuasive. Applicant has further added new claims, of these some comprise the same limitations as the previously presented claims and thus have been grouped together with the other claims in the rejection while others added new limitations which are obviated by a newly discovered piece of prior art. Following is an explanation as to why each of applicant's argument is not persuasive.

First, applicant's amendment that adds "isolation region" on each side of the node does not distinguish claim 42 from the prior art because a dielectric material as disclosed in Gambino et al. falls within the meaning of "isolation region". While the applicant argues that it is inconceivable to interpret Gambino et al. to cover this limitation, the examiner points out that "isolation region" is a term that has such broad meaning in the art that it encompasses any dielectric structure. Because Gambino et al. disclose a dielectric material around the nodes, the limitation of "isolation region" is met and thus the claim remains properly rejected as presented above.

Second, applicant's argument that claim 48 is independently patentable over the prior art because the prior art does not incorporate the n-type doped diffusion region into an anti-fuse construction and instead it incorporates a p-type diffusion region is not persuasive. A close reading of the Lowrey et al. reference evidences that while the invention described therein may form a fuse incorporating a p-type diffusion region, such is not the only way to construct the device. Lowrey et al. explicitly teach that the conductivity may be changed and that one with ordinary skill in the art would recognize

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this and have an expectation of success in doing so. (See col. 4, lines 45-61). Thus this claim is rendered obvious and has been properly rejected.

Third, applicant's argument that Lowrey et al. do not teach a plug made of conductive, doped polysilicon or that Lowrey et al. fails to teach a conductive plug altogether is not supported by the evidence on the record. Lowrey et al. teaches a doped polysilicon plug, see column 4, lines 10-15. Item 81 is a plug. Thus, this argument is also not persuasive and claim 53 remains properly rejected.

Fourth, applicant argues that Husher fails to teach a conductive plug, this, like the third argument is not supported by the evidence in the record. Husher teaches aluminum/copper plugs, see items 16a and 16b. In column 5, lines 9-10, Husher refers to item 16 as an interconnect layer, this is the same thing as a plug. Just because the figure in Husher may not look like an ordinary looking plug, its teachings from the specification are explicit with respect to what item 16 represents. Thus, applicant's arguments with respect to this point is also not persuasive.

Fifth, and final argument presented by applicant is with respect to the Wu reference and how applicant finds it inconceivable that one with ordinary skill in the art would achieve a structure wherein the TiN is laid against the dielectric and the tungsten is laid over the TiN layer. Referring to the Wu reference, specifically to column 1, lines 40-50, the examiner points out that the Wu reference states that the TiN layer "act as a barrier to prevent diffusion". Because TiN acts as a barrier, it must be against the dielectric otherwise it would not block the diffusion. Furthermore, Wu teaches the structure to comprise a sequential series of layers, the sequence being TiN, W, Al, TiN.

Thus, the TiN layer goes in first before any other layer. Hence, this argument is also not persuasive and the rejection stands.

Because the rejection stands as presented in the previous office action with the exception of the variation that was necessitated by the amendments, the examiner has decided to make this action final.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renzo N. Rocchegiani whose telephone number is (571)272-1904. The examiner can normally be reached on Mon.-Fri. 8:00 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Renzo N. Rocchegiani
Examiner
Art Unit 2825

A handwritten signature in black ink, appearing to read 'Matthew Smith', with a stylized, cursive script.

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800